

PHYSICS – (Theory)

Dec. 2022 – 2 hours



Name Index Number

Candidate's Signature Date

Instructions to candidates

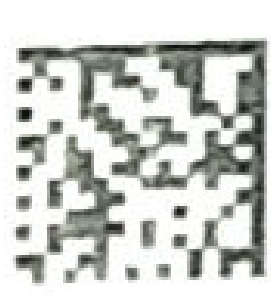
- (a) Write your name and index number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) This paper consists of **two** Sections; **A** and **B**.
- (d) Answer **all** the questions in Sections **A** and **B** in the spaces provided.
- (e) **All** working **must** be clearly shown in the spaces provided in this booklet.
- (f) Non-programmable silent electronic calculators may be used.
- (g) **This paper consists of 16 printed pages.**
- (h) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- (i) **Candidates should answer the questions in English.**

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| Section | Questions | Maximum Score | Candidate's Score |
|--------------------|-------------|---------------|-------------------|
| A | 1-13 | 25 | |
| | 14 | 09 | |
| B | 15 | 09 | |
| | 16 | 13 | |
| | 17 | 12 | |
| | 18 | 12 | |
| Total Score | | 80 | |

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SECTION A (25 marks)

Answer **all** the questions in this section in the spaces provided.

1. **Figure 1** shows three cardboards A, B and C with holes placed between a source of light and an observer.

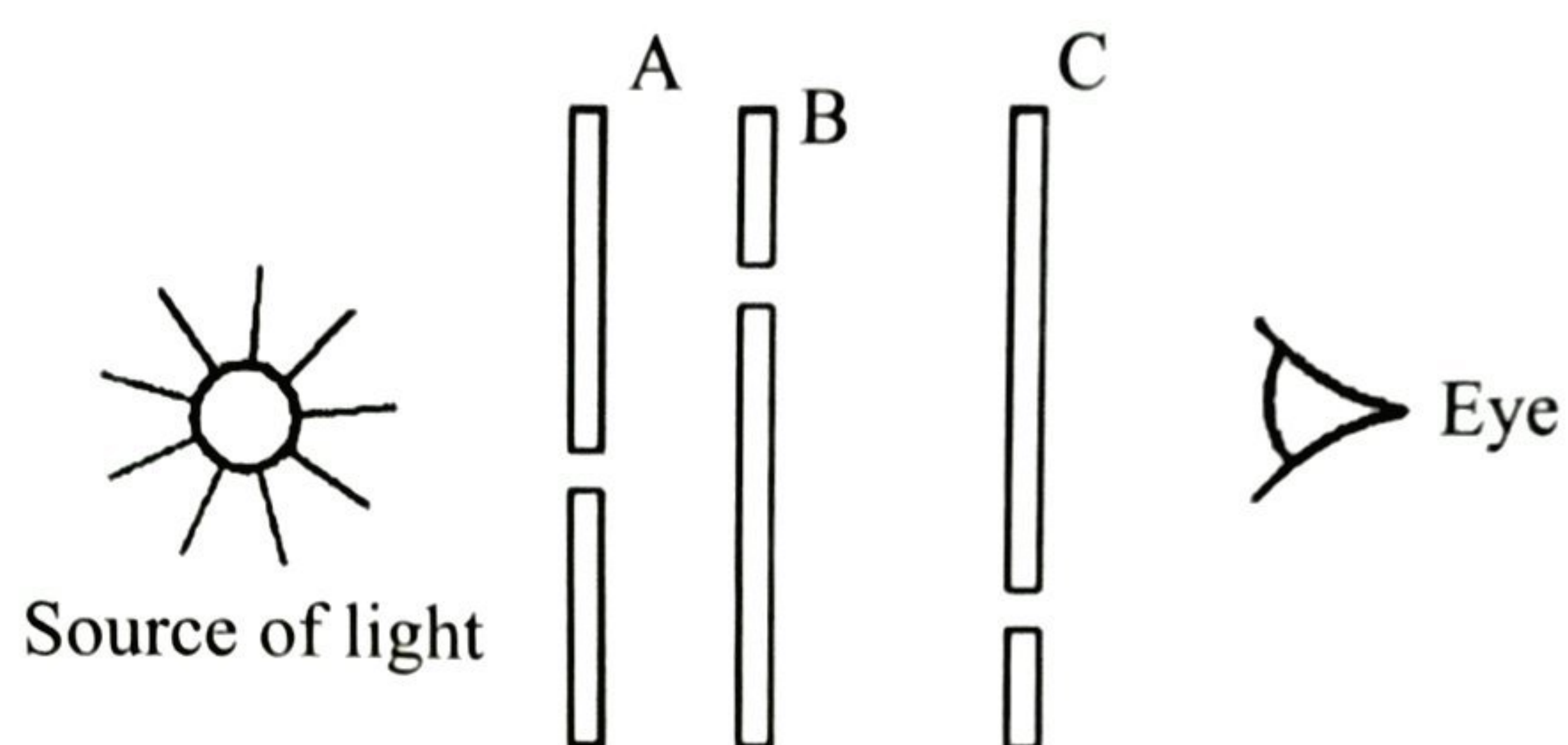


Figure 1

Explain what is observed.

(2 marks)

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2. State how a polythene rod acquires a negative charge when it is rubbed by a piece of cloth.

(1 mark)

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3. State **one** device that can be used to detect microwaves.

(1 mark)

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4. **Figure 2** shows an incomplete circuit.

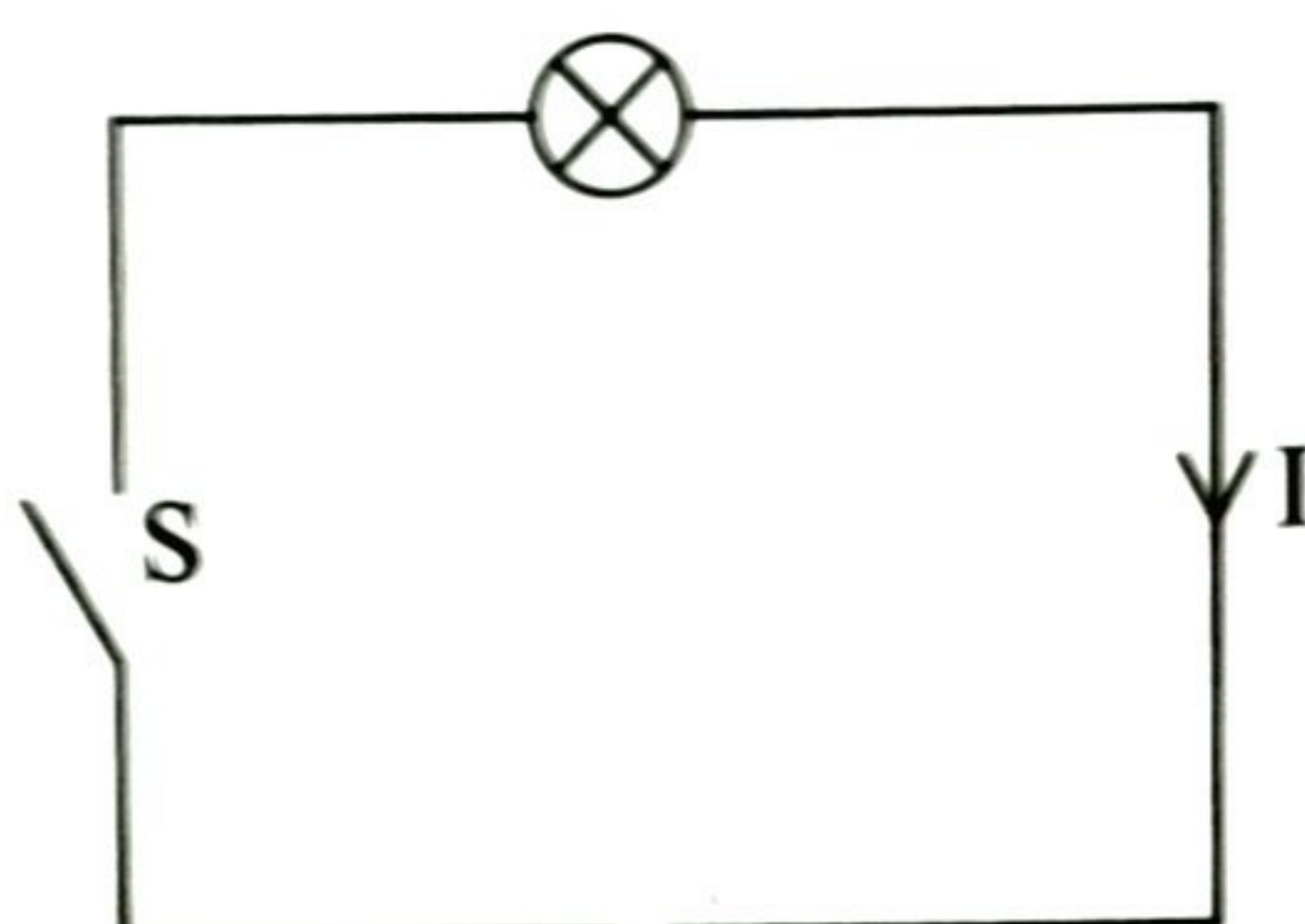


Figure 2

Complete the circuit by inserting a cell so that the current I flows in the direction shown when the switch S is closed. (1 mark)

5. State the basic law of magnetism. (1 mark)

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6. **Figure 3** shows a vertical object O placed in front of a concave mirror whose principal focus is at F .

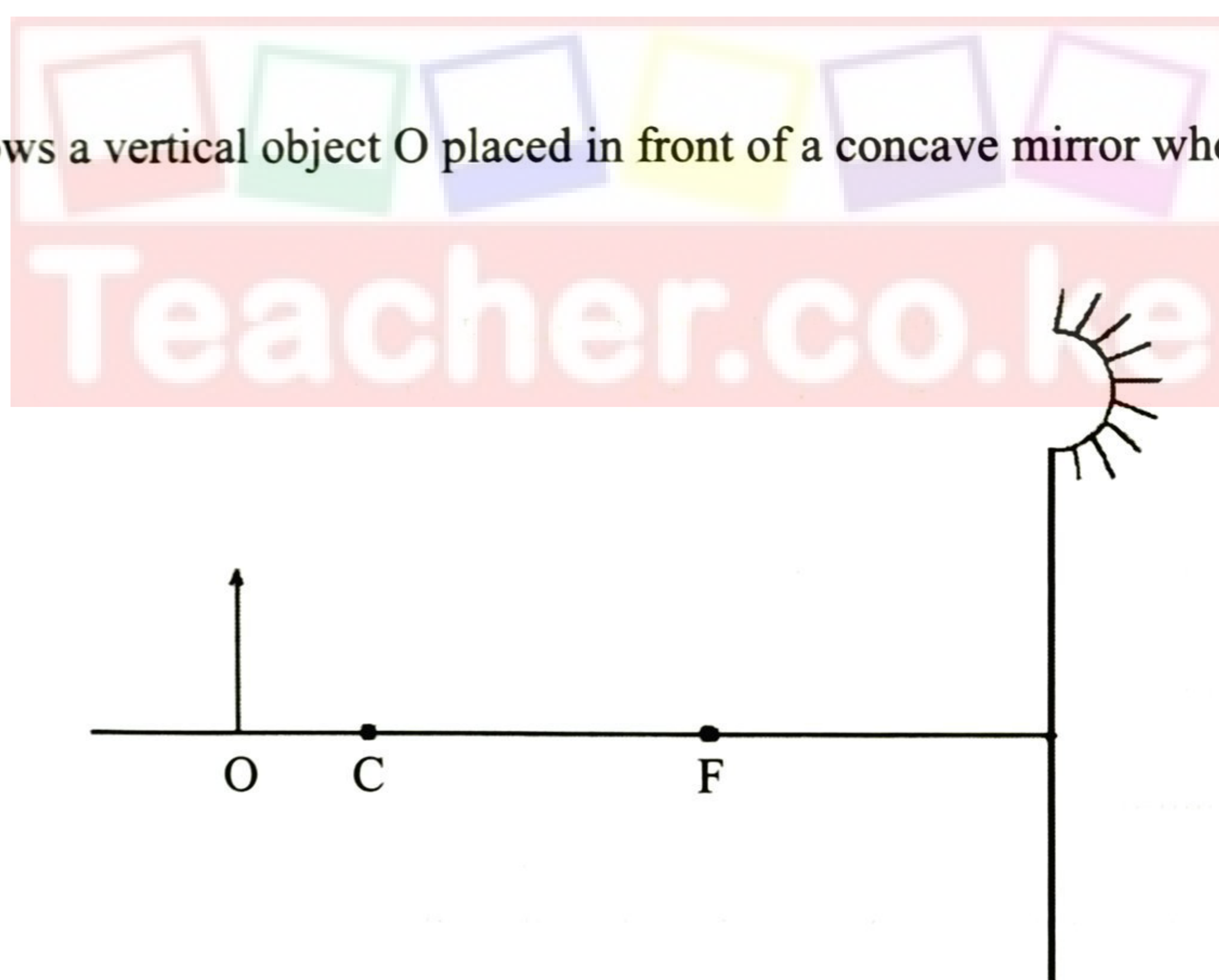


Figure 3

Draw a ray diagram to show how the image is formed. (3 marks)

7. State **two** properties of soft iron that makes it suitable for use as the core of the electromagnet of an electric bell. (2 marks)

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8. (a) State **one** reason why sound travels faster at sea level than on high mountains. (1 mark)

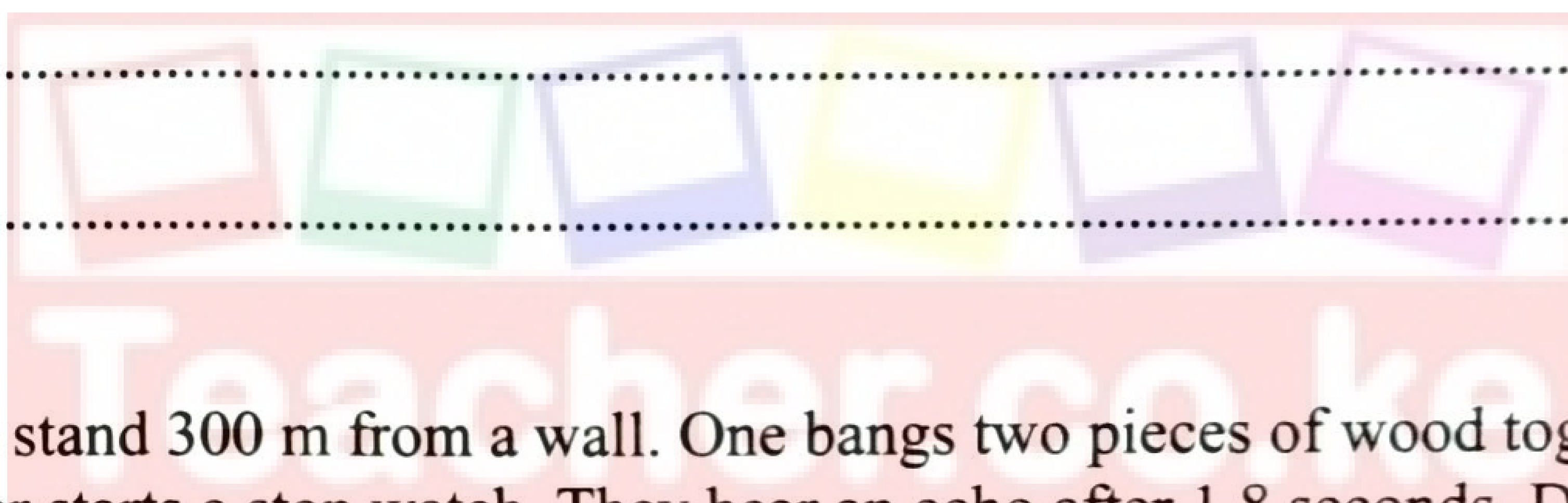
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(b) State **one** condition necessary for two progressive waves to form a standing wave. (1 mark)

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9. Two students stand 300 m from a wall. One bangs two pieces of wood together and at the same time, the other starts a stop watch. They hear an echo after 1.8 seconds. Determine the speed of sound in air. (3 marks)

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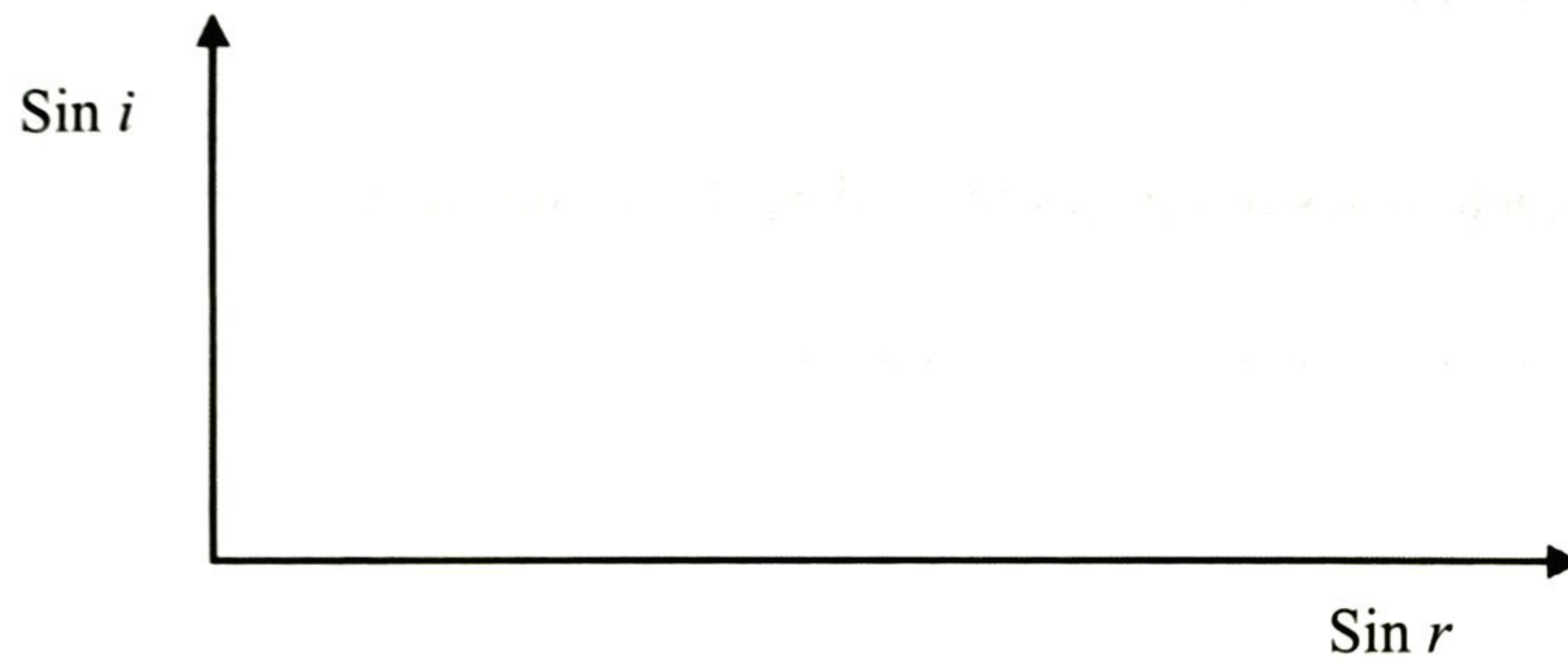
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10. During an experiment to investigate the relationship between the angle of incidence i , and angle of refraction r for a ray of light travelling from air to glass, the values of $\sin i$ and $\sin r$ were determined.

- (a) On the axes provided, sketch the graph of $\sin i$ against $\sin r$ for the values that were obtained. (1 mark)



- (b) State how the refractive index of the glass can be obtained from the graph. (1 mark)

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11. Figure 4 shows a circuit consisting of two resistors of 4Ω and 8Ω , a cell and voltmeters V_1 and V_2 .

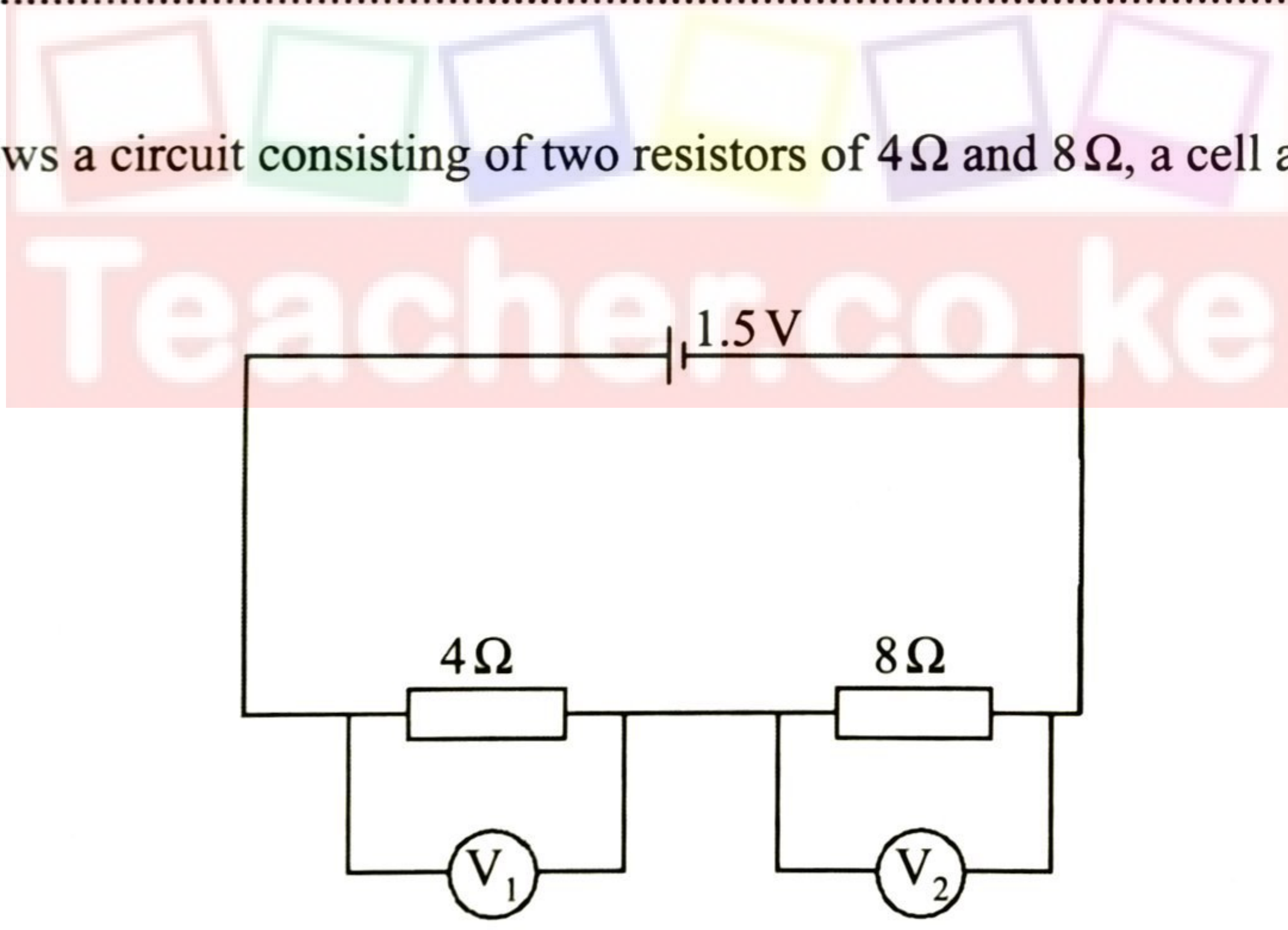


Figure 4

It is observed that voltmeter V_2 shows a higher reading than V_1 . Explain this observation. (2 marks)

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12. A heating element is rated 3 kW, 240 V. Determine the resistance of the element. (3 marks)

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13. State **two** characteristics of images formed by diverging lenses. (2 marks)

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SECTION B (55 marks)

Answer all the questions in this section in the spaces provided.

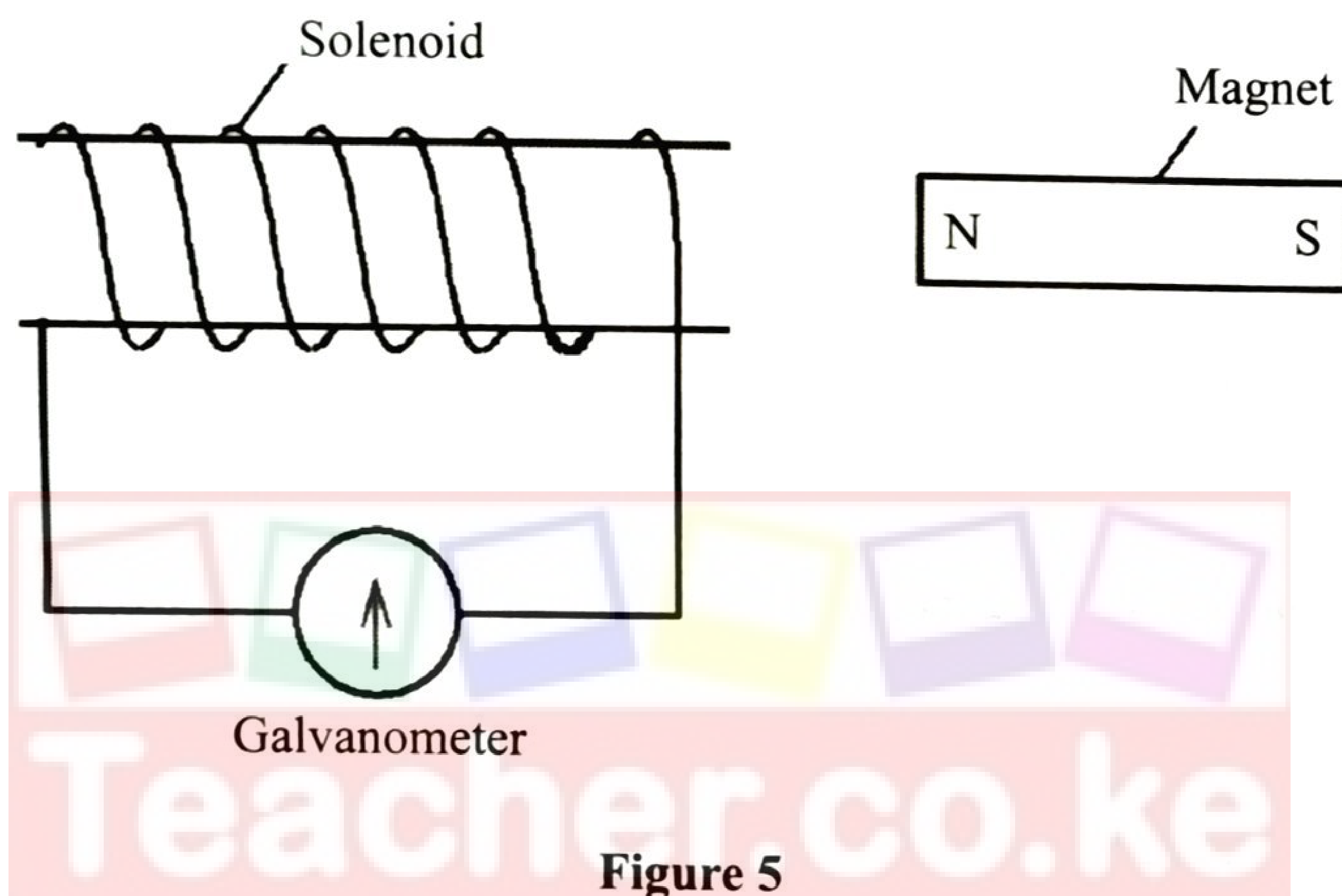
14. (a) State Lenz's law of electromagnetic induction. (1 mark)

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- (b) **Figure 5** shows a magnet held near a stationary solenoid.



State what will be observed on the galvanometer when the:

- (i) north pole end is pushed into the solenoid (1 mark)

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- (ii) magnet is held stationary inside the solenoid (1 mark)

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(iii) north pole end is pulled out of the solenoid

(1 mark)

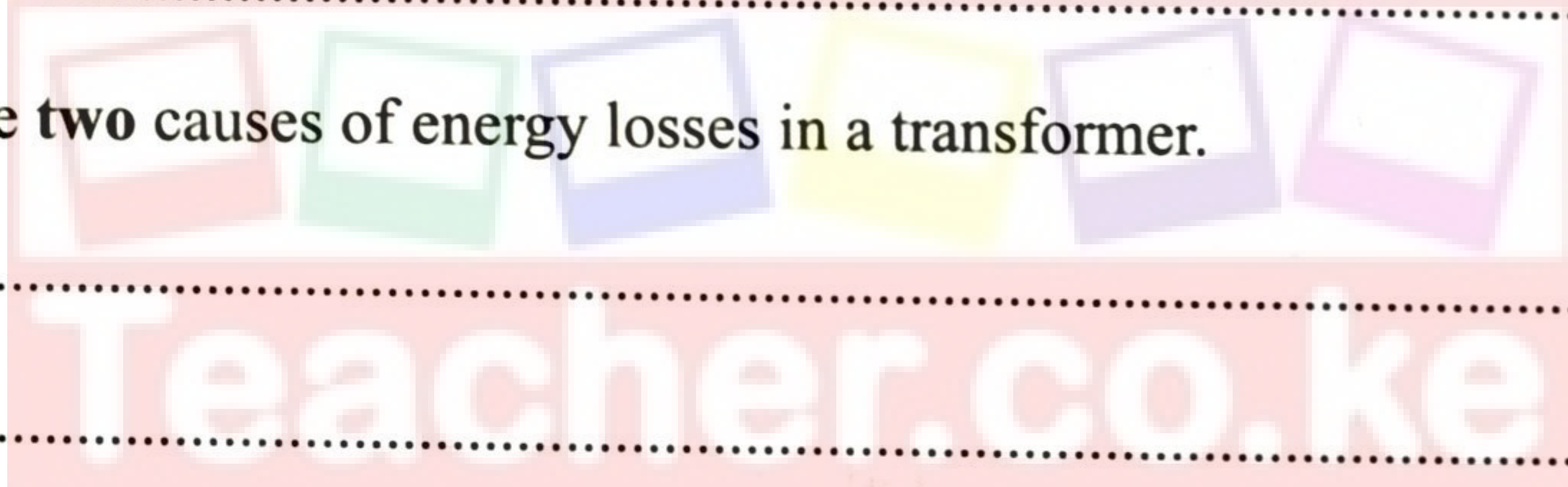
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(c) Explain what would be observed if the North pole of the magnet is now moved into the solenoid at a higher speed. (3 marks)

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(d) State **two** causes of energy losses in a transformer. (2 marks)

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15. (a) State the function of the ring main circuit in a domestic wiring system. (1 mark)

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(b) Figure 6 shows a circuit consisting of switches S_1, S_2, S_3 and three identical lamps L_1, L_2 and L_3 connected to the mains supply through a fuse.

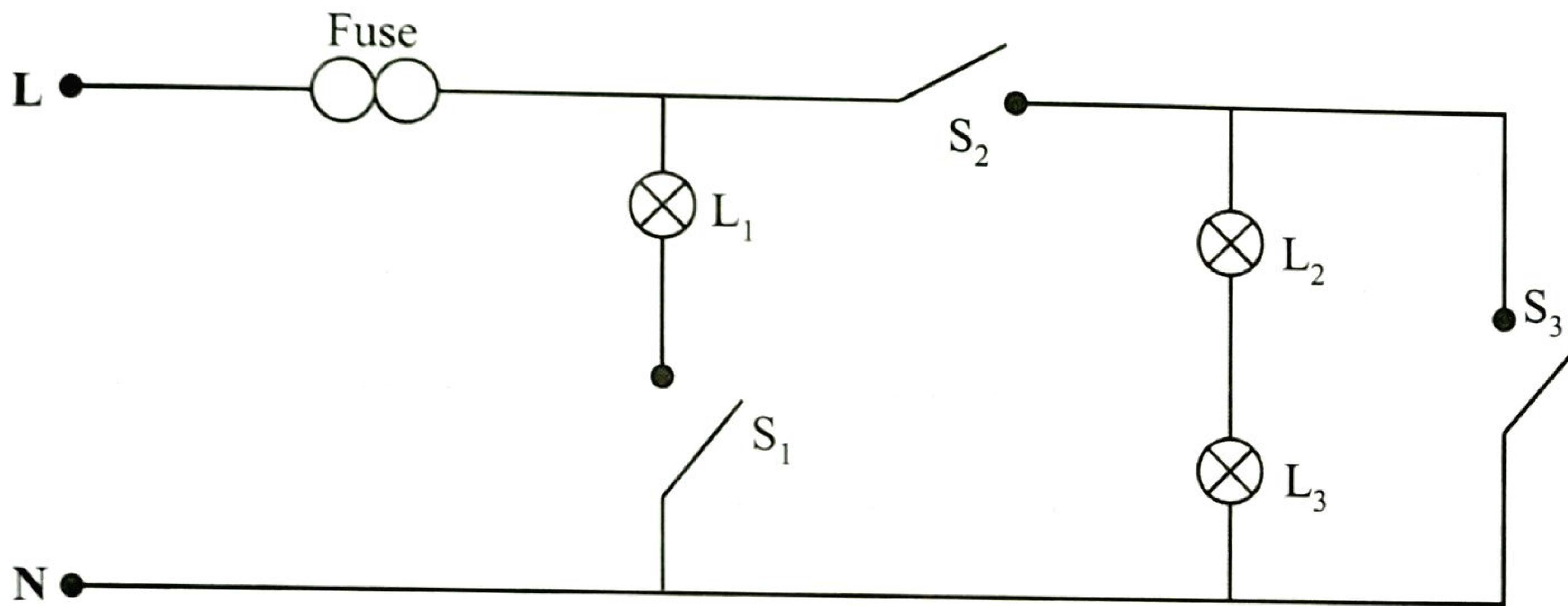


Figure 6

(i) Identify **two** faults in the circuit. (2 marks)

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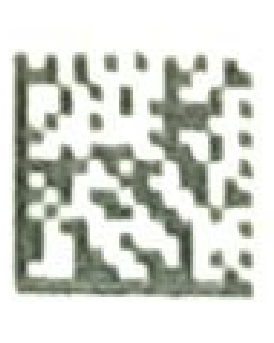
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(ii) State the reasons for the answers in 15(b)(i). (2 marks)

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- (iii) Describe how the brightness of lamps L_1 , L_2 and L_3 compare when the switches S_1 and S_2 are closed. (2 marks)

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- (iv) Explain the answer in 15(b)(iii). (2 marks)

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16. (a) **Figure 7** shows a circuit consisting of a cell in series with a galvanometer and two metal plates A and B.

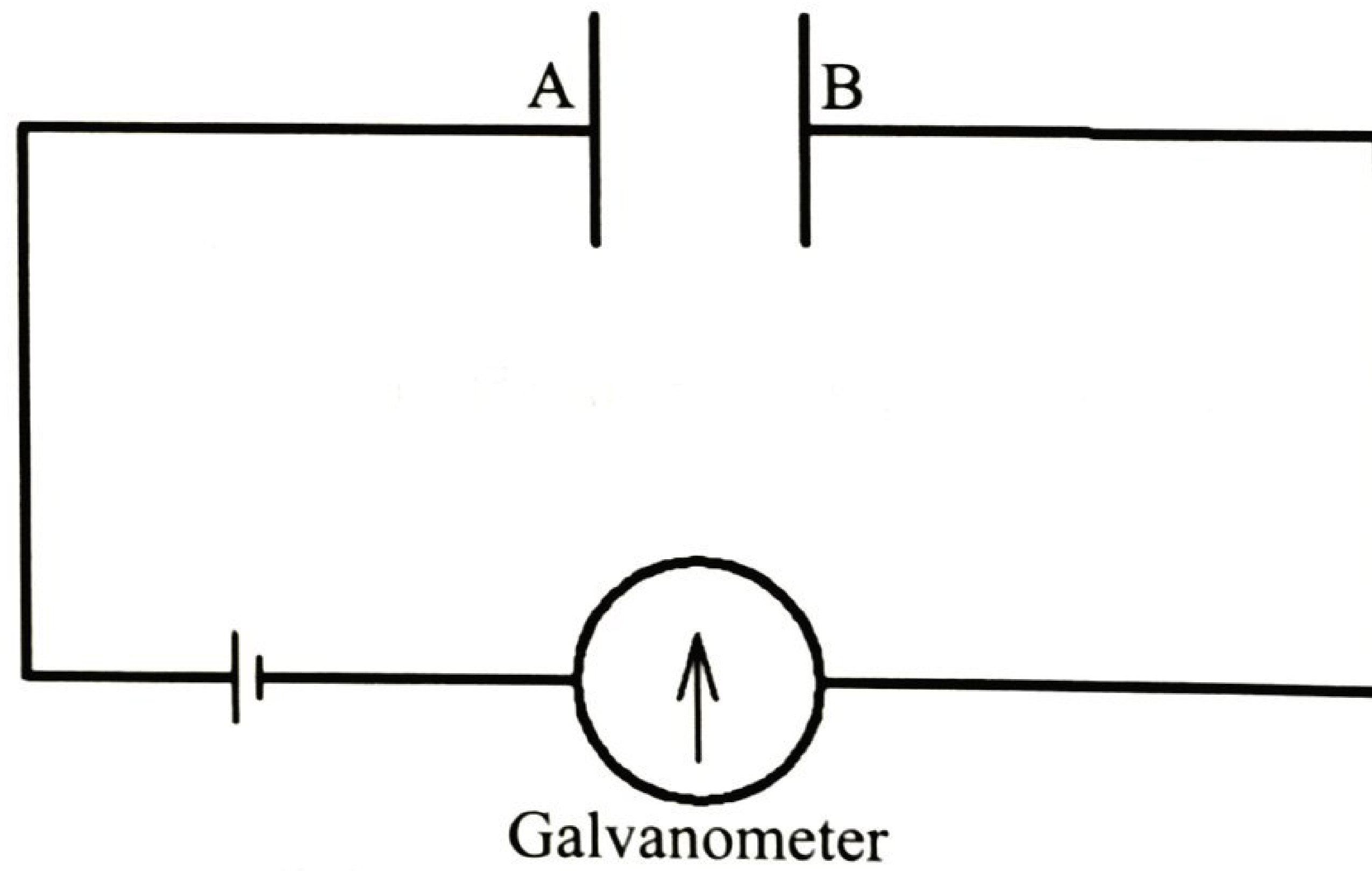


Figure 7

- (i) It is observed that when a beam of UV radiation falls on plate B, the galvanometer deflects. Explain this observation. (3 marks)

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- (ii) Explain what would be observed on the galvanometer when a more intense beam of UV radiation is used. (2 marks)

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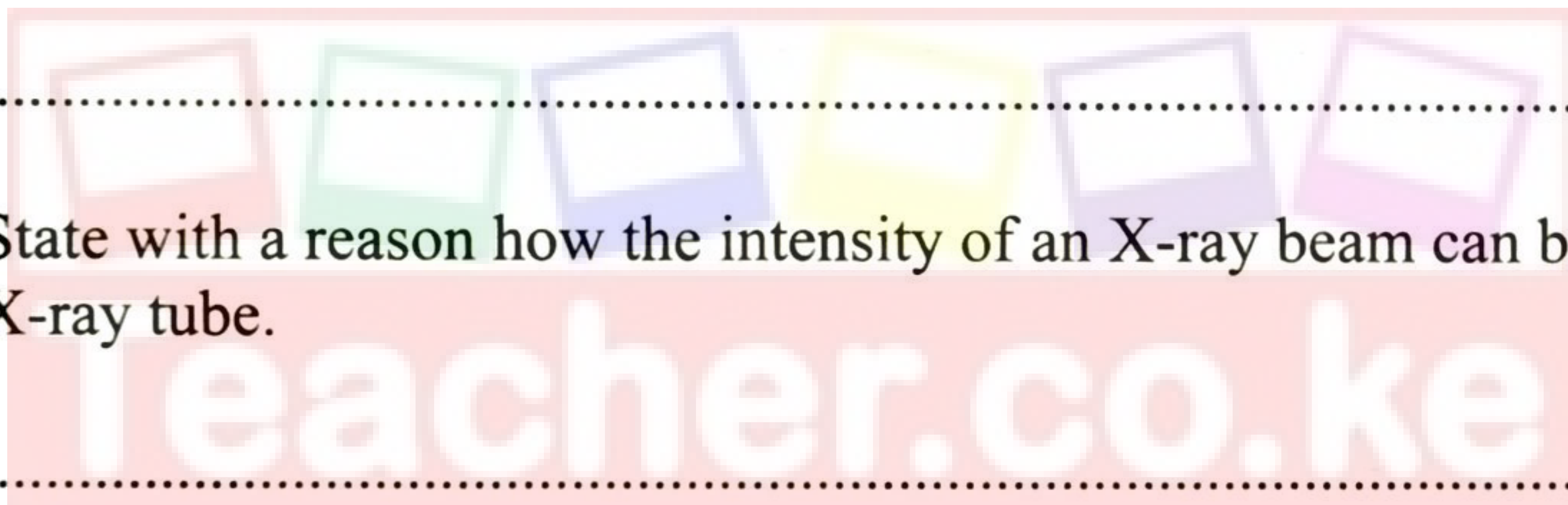
- (b) (i) State with a reason how the intensity of an X-ray beam can be increased in an X-ray tube. (2 marks)

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- (ii) **Figure 8** shows the trace of an AC signal on the screen of a Cathode Ray Oscilloscope (CRO).

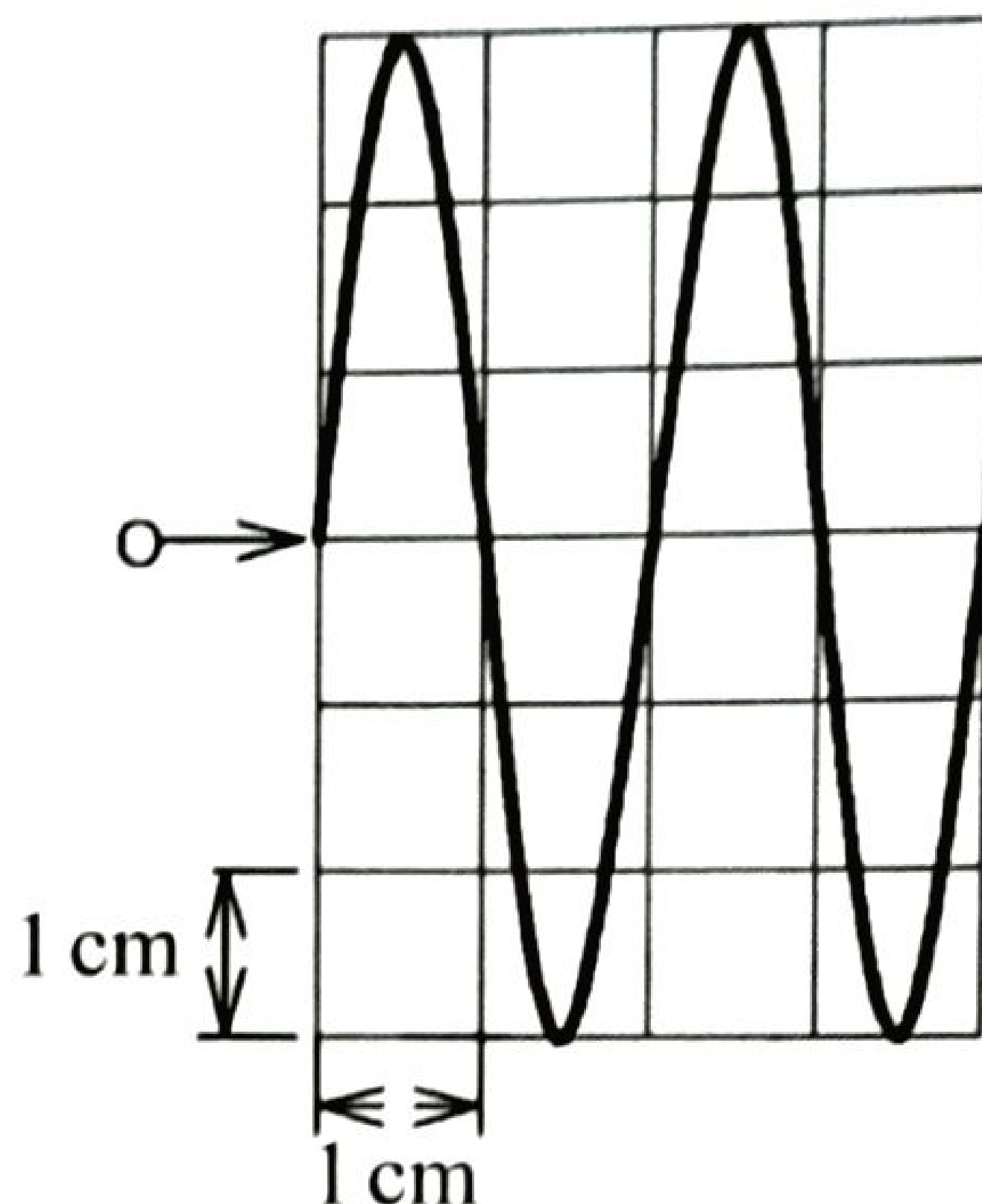


Figure 8

Given that the time base setting is 8.5 milliseconds per cm. Determine the:

- I. wavelength of the AC signal (1 mark)

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- II. frequency of the AC signal (3 marks)

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- (iii) State the functions of the following parts of a Cathode Ray Oscilloscope:

- I. The grid (1 mark)

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- II. The filament (1 mark)

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17. (a) State **one** hazard of radioactivity. (1 mark)

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(b) **Figure 9** shows a decay curve of a radioactive element.

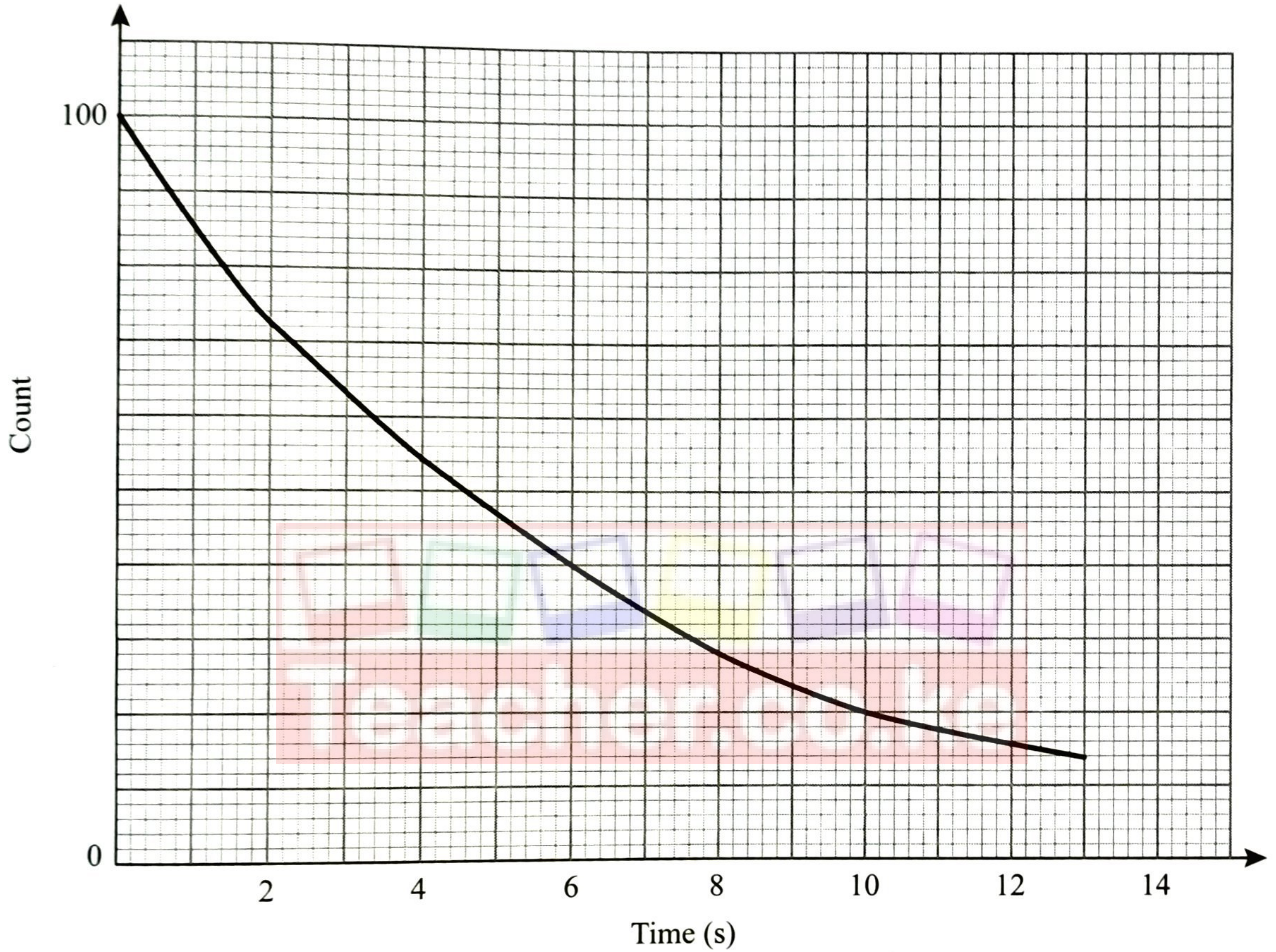


Figure 9

From the graph determine:

(i) the half life of the element (1 mark)

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(ii) the number of half lives it will have undergone when the count is 12.5 (2 marks)

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(c) (i) State the effect of doping on a semiconductor. (1 mark)

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(ii) Explain how doping produces an n-type semiconductor from a pure semiconductor. (3 marks)

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(iii) **Figure 10** shows a circuit consisting of two galvanometers G_1 and G_2 , two switches S_1 and S_2 , a cell and two diodes D_1 and D_2 .

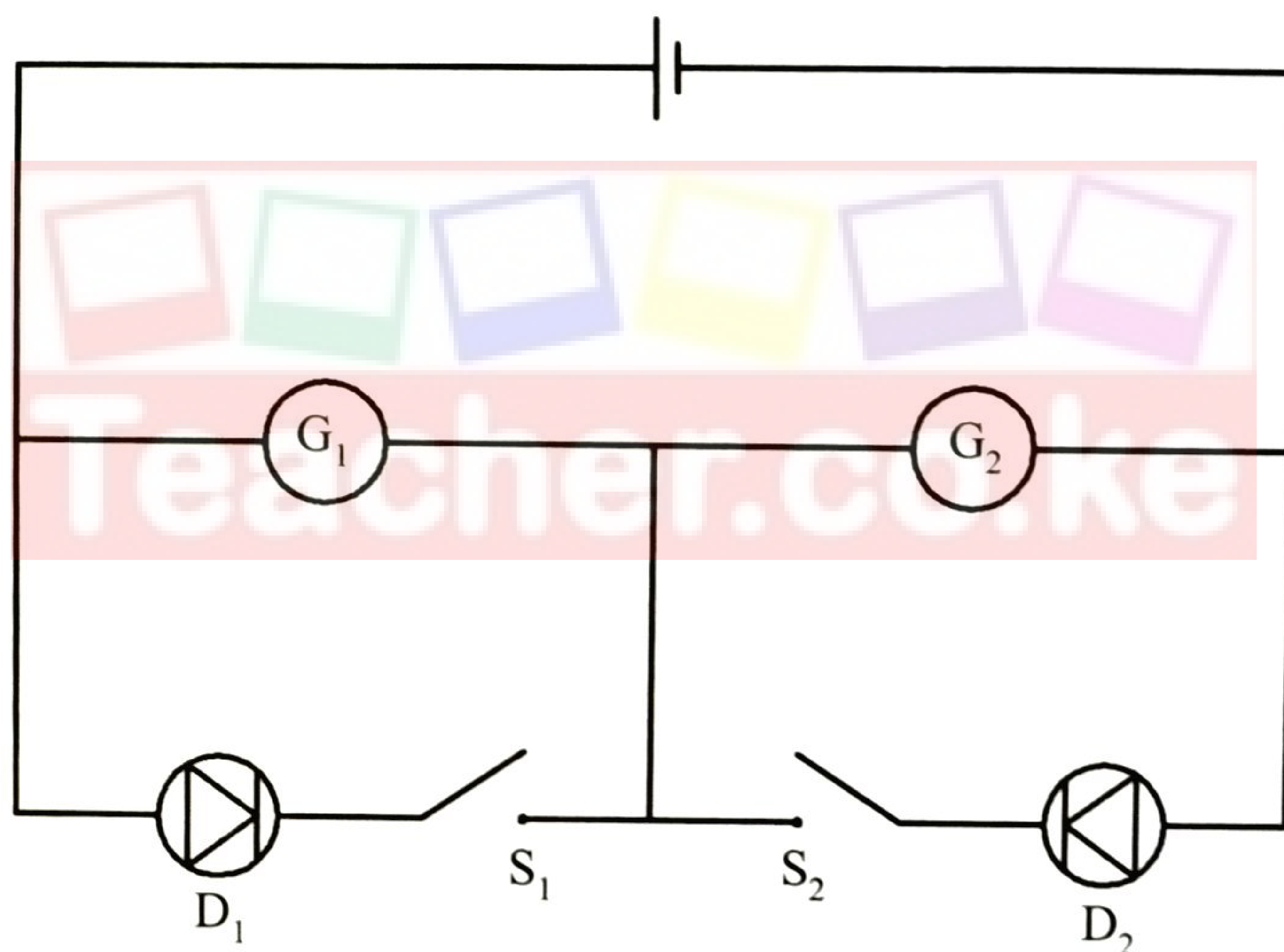


Figure 10

Explain what is observed when S_1 and S_2 are closed. (4 marks)

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18. (a) Explain the effect on resistance of a diode when the forward bias voltage is increased. (2 marks)

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- (b) **Figure 11** shows a circuit consisting of a 12 V battery, 1.5 k Ω resistor, a Light Dependent Resistor (LDR) and a lamp of negligible resistance. The circuit can be used as a light detector.

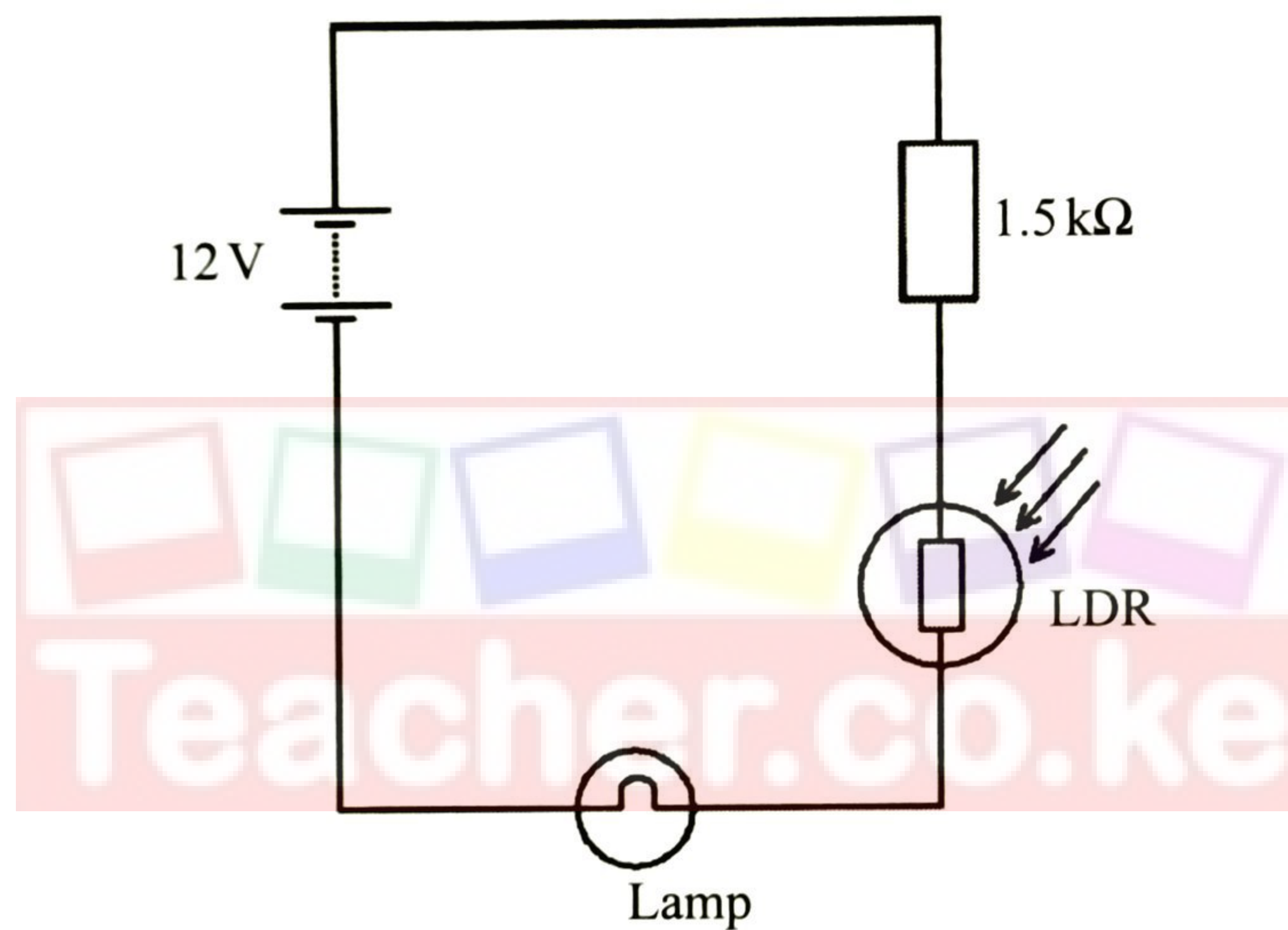


Figure 11

- (i) Explain what would be observed if the lighting conditions are changed from total darkness to bright light. (3 marks)

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- (ii) If the resistance of the LDR in bright light is $1 \times 10^3 \Omega$, determine the potential difference across the $1.5 \text{ k}\Omega$ resistor. (3 marks)

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- (c) State the function of a capacitor in rectification of an alternating voltage. (1 mark)

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- (d) Figure 12 shows two capacitors of $2.5 \mu\text{F}$ and $10 \mu\text{F}$ in series with a 12 V battery.

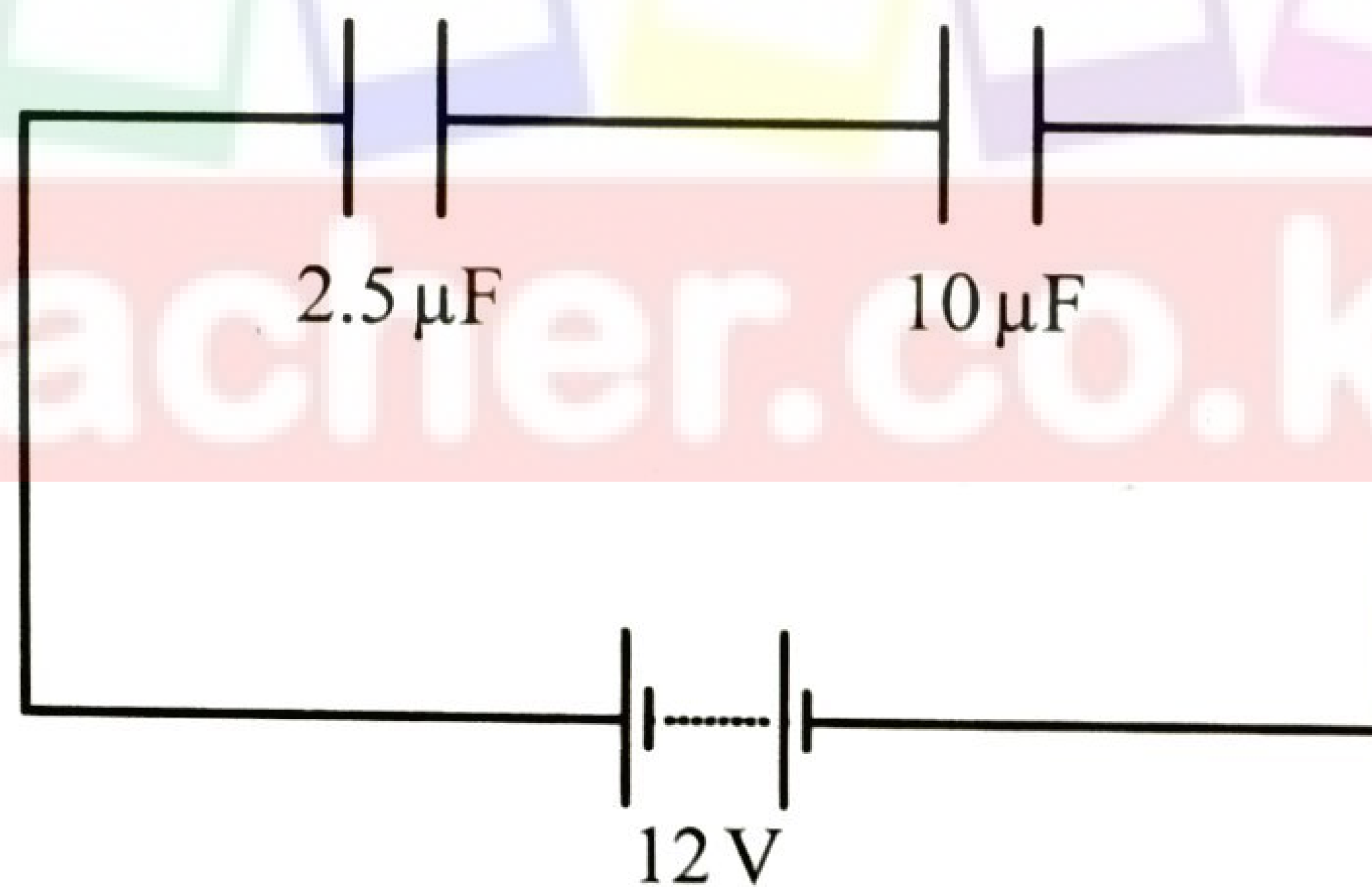


Figure 12

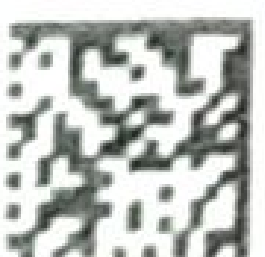
- Determine the total charge stored by the capacitors. (3 marks)

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